

# **THE WATER USE CYCLE**

## **WASTEWATER TREATMENT**

The average American produces 60 to 150 gallons of domestic wastewater each day. This wastewater is composed of far more than human biological waste and includes water resulting from showers, brushing teeth, dish washing, washing clothes, cooking, garbage disposals and more. Homes with indoor plumbing have one set of water pipes to deliver fresh treated water and another set of pipes to carry away the wastewater generated. This wastewater contains biological solids, dirt, soaps, food, grease, phosphates and nitrates and whatever else is “dumped down the drain.” Untreated wastewater also contains pathogenic organisms such as bacteria and viruses that can cause problems with water quality and disease. In the past wastewater from a home was often simply released to a local stream or river to be carried away. A larger community might have used a network of underground pipes (sewer lines) that directed the wastewater to an adjacent river.

Ironically, drinking water is often obtained from the same rivers and streams that receive wastewater discharges and drinking water systems using groundwater can also become easily contaminated by untreated wastewater. Worldwide waterborne diseases are still the leading cause of infant mortality (World Bank) and untreated wastewater can also severely impact aquatic ecosystems. High levels of organic matter, phosphate and nitrate found in untreated wastewater can trigger bacterial growth blooms, consuming most of



the oxygen in the water and resulting in fish kills. Phosphates and nitrates in wastewater can trigger algae blooms that can affect water turbidity and reduce the recreational value of a local waterway.

With increased human populations and trends towards centralization of modern societies, most regions now require that wastewater be treated prior to discharge to a local water system. Treatment of wastewater falls under two main categories: *municipal treatment systems* (pictured left) serving residents of large communities who are connected to a centralized sewer system, and individual *on-site* residential (*septic*) systems.

The municipal wastewater treatment plant receives wastewater from a complex sewer system where the wastewater simply flows to the plant or is pumped to the site using *lift stations*. The plant processes the wastewater prior to discharge to a local waterway. The level of treatment varies depending on the amount of wastewater being treated, the type of water system receiving the discharge, and local regulations. In general, solids are

removed (primary treatment), and then bacteria are encouraged to reduce the organics in the wastewater (secondary treatment). Phosphates and nitrates are reduced (tertiary treatment) and the final effluent sanitized (often with chlorine) prior to release.



For residents who are not connected to a central sewer system, some form of on-site treatment is required, often in the form of a septic tank.

These systems require proper maintenance or they can malfunction. When a septic system fails, raw wastewater can pool on the property creating a health hazard and leading to contamination of a drinking water well or local watershed. *Guidelines for how septic systems work and how to optimize their performance are included in this section.*

Adequate treatment of wastewater is a critical issue in terms of human health. Epidemics of cholera, typhoid fever, gastroenteritis, hepatitis and cryptosporidiosis have arisen during the course of history as a direct result of wastewater contamination of drinking water supplies. Such diseases have been responsible for the death of millions. A four-year epidemic of dysentery in Central America in the 1960s resulted in 500,000 cases of illness and the estimated death of 20,000. An outbreak of cryptosporidiosis in Milwaukee in 1993 affected more than 400,000 people and claimed 104 lives. – *National Small Flows Clearinghouse.*